The Canadian FHIR Exchange Specification (CA:FeX)

Optimizing Canada's Health System Resources through Patient-Centered Health Information Exchange

March 2023

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Definitions

Application Programming Interface (API): a way for two or more computer programs to communicate with each other. It is a type of software interface, offering a service to other pieces of software.[1]

CA-Core: pan-Canadian core specification, currently under development, which will provide holistic guidance and a set of profiles that will drive standardization in implementations that leverage FHIR to express and exchange concepts from the pan-Canadian core data model. *Note:* An *internationally consistent definition for National Core specifications is outstanding. Within this whitepaper, the term CA-Core is used to express profile-bound pan-Canadian rules that specifications like CA:FeX can leverage.*

Canadian FHIR Exchange (CA:FeX): seeks to promote RESTful FHIR exchange patterns, developed by industry-leading FHIR standards that can be applied on top of an existing non-FHIR infrastructure just as easily as it can be applied on top of FHIR servers.

Health Level Seven (HL7®) Fast Healthcare Interoperability Resources (FHIR®): a next generation standards framework created by HL7, designed to enable the exchange of healthcare-related information. FHIR combines the best features of HL7's v2, HL7 v3, and CDA product lines while leveraging the latest web standards and applying a tight focus on implementability.[2]

International Patient Summary (IPS): The IPS is a minimal, non-exhaustive set of data elements defined by ISO/EN 17269 and realized by HL7 in both CDA and FHIR. The IPS is a snapshot clinical document that can be used for planned or unplanned care of a person locally or across borders. It emphasizes the data required and the necessary conformance of the use cases for an international patient summary.[3]

Learning Health System: a learning health system as a health system in which internal data and experience are systematically integrated with external evidence, and that knowledge is put into practice. As a result, patients get higher quality, safer, more efficient care, and health care delivery organizations become better places to work.[4]

RESTful Exchange: Many applications run on a mobile device or web browser use the information exchange standard REST (Representational State Transfer) as the basis for their APIs. REST is a method of exchanging information using the World Wide Web standard transfer protocol HTTP. REST means that each request from any client and response from the server contains all the information necessary to service the request. The exchange of data using REST is termed a "RESTful" exchange.[5]

SMART on FHIR: an open, free, standards-based API, used to write an app once and have it run anywhere in the healthcare system.[6]

[1] Wikipedia. https://en.wikipedia.org/wiki/API
[2] HL7 FHIR. http://www.hl7.org/implement/standards/fhir/summary.html
[3] IHE International Patient Summary. https://wiki.ihe.net/index.php/International_Patient_Summary_(IPS)
[4] Agency for Healthcare Research and Quality. https://www.ahrq.gov/learning-health-systems/about.html
[5] The Office of the National Coordinator for Health Information Technology, The FHIR API. https://www.healthit.gov/sites/default/files/page/2021-04/FHIR%20API%20Fact%20Sheet.pdf
[6] SMART. https://smarthealthit.org/

Interoperability and Person-Centered Care

Advancing Interoperability in Canada

Canada is transitioning towards a person-centric model of care in response to increasing calls by patients and their care teams to have ready access to the right health data, at the right time, in the most effective care-setting for quality health care. An aging population with increasingly complex healthcare needs, emerging public health risks and the continued growth of electronic clinical documentation are all driving the need to be able to exchange detailed health data between digital health solutions, ensuring these solutions "speak the same language".

A Canadian health data modernization strategy will require industry wide support for new health information exchange protocols with vendor solutions employing modern, predictable, API based integrations. Jurisdictions and industry at large are already designing the next generation of API Gateways integrated with digital identity support and Health Level 7 (HL7) Fast Healthcare Interoperability Resources (FHIR®)-based protocols. Achieving meaningful advances in interoperability in Canada will require the support and active participation of all levels of government, health authorities, software vendors, academia and other health system stakeholders.

The current moment presents the opportunity to rally around an industry wide, standardized, and modern approach to health information exchange. The Canadian FHIR Exchange (CA:FeX) protocol has the potential to fill this gap and provide the needed guidance to align the market, enable rapid advancement in the state of Canadian health information exchange and support execution of the pan-Canadian Health data strategy.

Modernizing Health Information Exchange

In support of the provinces and territories, Canada Health Infoway ("Infoway") is facilitating a national, collaborative effort to advance interoperability which includes the creation and evolution of CA:FeX, as part of the pan-Canadian Interoperability Strategy & Shared Roadmap.

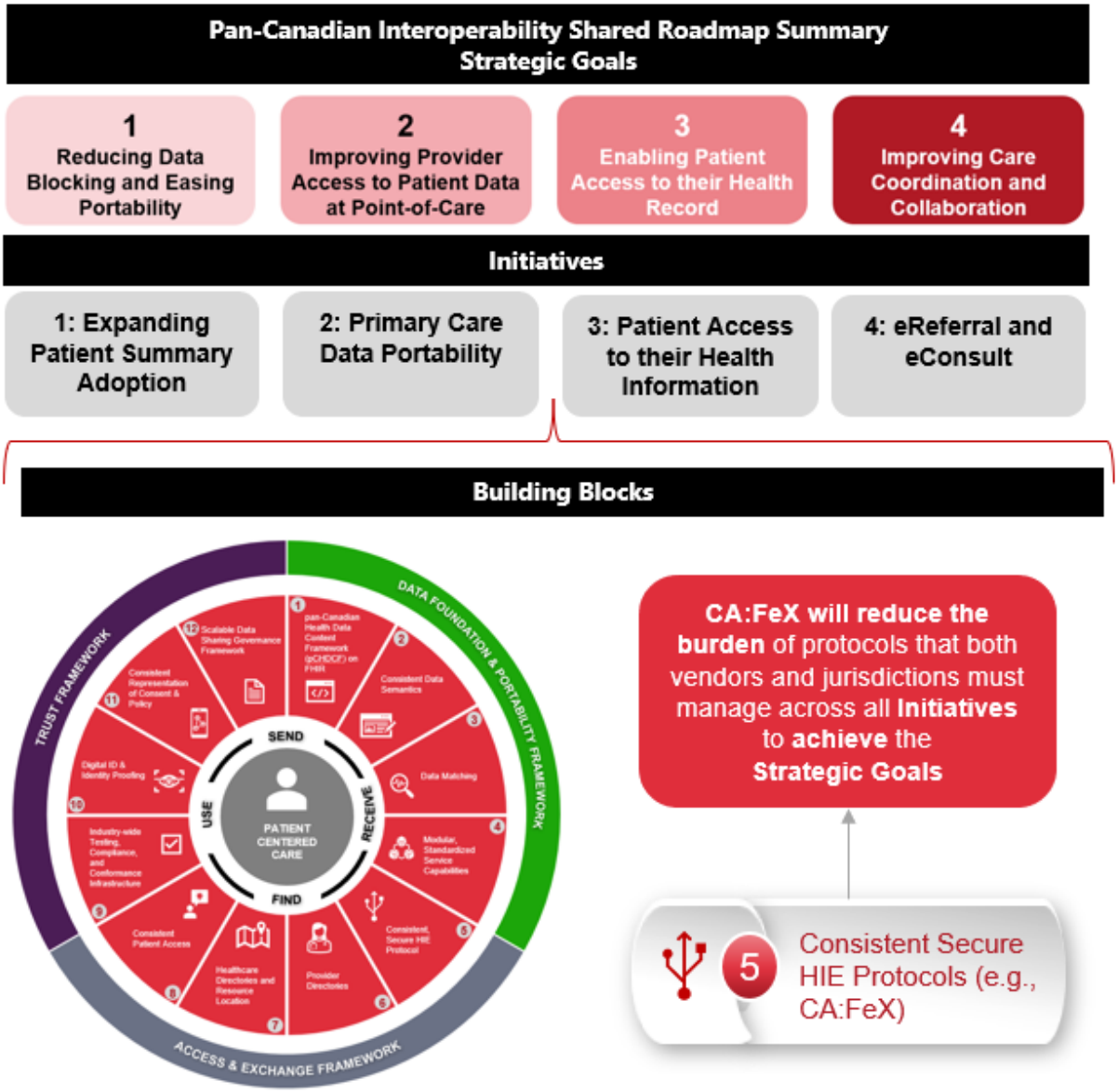
The interoperability roadmap includes a set of strategic goals in which initiatives/programs (e.g., eReferral and eConsult) will be identified over time based on jurisdictional priorities across the country. As these initiatives/programs progress, they will naturally require various interoperability building blocks (e.g., reference architectures, data standards, trusted exchange frameworks, digital identity, patient/provider access, etc.) that will be designed and developed to enable successful implementation of the initiatives. This approach will enable the creation of core capabilities and drive the maturation of each building block over time.

Consistent Secure Health Information Exchange Protocols (e.g., CA:FeX), one of the core building blocks, focuses on building a pan-Canadian convergence toward a health information exchange protocol that reduces optionality in favor of large-scale spread. This will reduce the burden of protocols that both vendors and jurisdictions must manage. Key components of this building block include:

- Development and adoption of a secure, modern and predictable Health Information Exchange (HIE) specification that achieves standardization of a minimum set of capabilities at scale (identifies the fewest number of HIE protocols necessary to exchange health information)
- The HIE protocol's integration with policy and consent-based access to data (privacy by

design)

- Integration of common data standards into the HIE protocols (Building Blocks #1 and #2, as defined in the pan-Canadian Interoperability Strategy & Shared Roadmap).



CA:FeX, an output of the Consistent Secure Health Information Exchange Protocols building block, will enable HIE to be scalable and predictable in Canada. The Office of the National Coordinator for Health Information Technology (ONC) defines HIE as follows:

Electronic health information exchange (HIE) allows doctors, nurses, pharmacists, other health care providers and patients to appropriately access and securely share a patient's vital medical information electronically - improving the speed, quality, safety and cost of patient care.

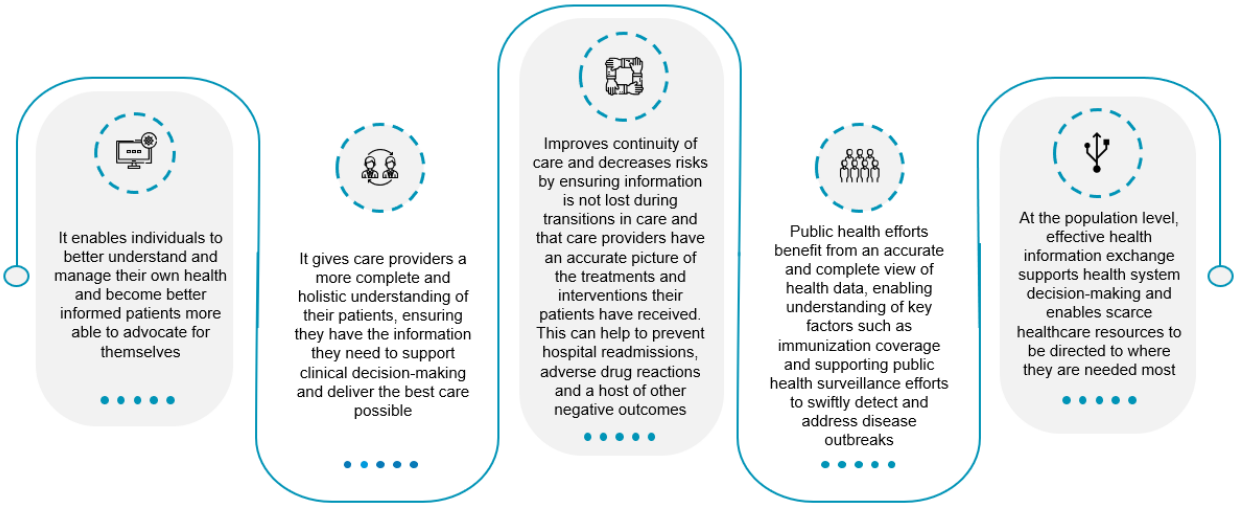
While electronic health information exchange cannot replace provider-patient communication, it can greatly improve the completeness of patient's records, (which can have a big effect on care), as past history, current medications and other information is jointly reviewed during visits.

Appropriate, timely sharing of vital patient information can better inform decision making at the point of care and allow providers to avoid readmissions, avoid medication errors, improve diagnoses and decrease duplicate testing.[7]

Clearly, effective exchange of electronic health data offers enormous potential value to providers, patients, and the health system. As the pan-Canadian health data ecosystem evolves, the task will be to move from closed systems that were built to support traditional models of care to more intelligent, distributed systems that can scale across pan-Canadian jurisdictions.

Person-Centered Health Information Exchange

With the continued growth of clinical information systems and the emergence of consumer-focused health applications, more health data than ever is captured electronically. Enabling person-centered health information exchange will help to unlock the value of this data to support the health system and benefit all Canadians:



[7] The Office of the National Coordinator for Health Information Technology (ONC). https://www.healthit.gov/topic/health-it-and-health-information-exchange-basics/what-hie#:~:text=Electronic%20health%20information%20exchange%20(HIE,and%20cost%20of%20patient%20care.

Health Information Exchange in Canada

Establishing our Position in the International Community

Canada has lagged many other comparable nations in its progress on the journey toward person-centered health information exchange. Attached and unattached patients in Canada experience sub-optimal coordination of care, lengthy wait times for certain procedures, and less value for money than other universal health care systems that form part of the Organization for Economic Cooperation and Development (OECD) member countries. The OECD ranks Canada among the most expensive of its member universal-access health-care systems, with availability of and access to health care resources below that of the average OECD country, with mixed results for health service quality and clinical performance. One of the most compelling characteristics of high performing health systems is the effective, efficient, and timely exchange of health data to support patient care, population health and health-system outcomes.

Countries such as the United States and United Kingdom are further along in building a foundation for interoperability, including mature, well adopted interoperability standards, policies, and infrastructure; they continue to move forward with an adaptive, incremental approach to building their learning health system based on what they have already established.

Adopting FHIR for Modern HIE

HL7 FHIR® is rapidly becoming a key enabler of modern health information exchange solutions around the world. According to HL7 International, FHIR® is increasing its footprint in empowering patients to access health data via third-party apps across a growing number of countries, including the United States, United Kingdom, Australia, France, and many more.[8] These countries are mobilizing policies, standards, and technology to place the patient at the center of care and build the foundation for a learning health system.

The FHIR® standard is based on widely used internet standards that are not specific to health care, including (but not limited to) RESTful exchange and the organization of elements into packages of information ("Resources"). Simply put, ***FHIR applies modern approaches to structuring and exchanging data that have been successful in other domains to healthcare***.

While there are other legacy data standards available (e.g., HL7 v2, CDA, etc.), the adoption of FHIR enables an open API ecosystem that promotes a 'plug and play' digital app approach to solving complex care across the continuum. Moving to an open standard removes barriers to participation and enables the health sector to benefit from best practices and lessons learned elsewhere. It also enables healthcare organizations to choose digital health products that best meet the needs of their population, lower cost of integration, and improved sustainability of digital health ecosystems.

The pan-Canadian health information technology ecosystem is a complex and challenging environment for vendors to build scalable, interoperable solutions. Various provinces, territories and health authorities have a diverse mix of new and legacy clinical information systems and widely varying capabilities around health data standards and health information exchange. Variations across Canada notwithstanding, achieving an environment where data is easily

[8] Isaac Vetter,'International Patient Access', *HL7 International,* The Official Blog of Health Level Seven® International, August 15, 2022. https://blog.hl7.org/international-patient-access

organized, accessed, and exchanged in a person-centric way still requires countless decisions and achieving consensus on a broad range of issues. However, with the move to FHIR, there is a path forward.

The Canadian FHIR Exchange (CA:FeX) Interoperability Specification

To accelerate and scale health information exchange across Canadian jurisdictions, a ***common foundational standard that all jurisdictions can conform to*** with their existing clinical information systems and digital health solutions is required. Critically, this solution must have the flexibility to accommodate unique local needs various degrees of maturity in the journey toward a health record comprising more discrete data represented using standard terminologies.

With this in mind, sustainable and successful data interoperability aligned with a pan-Canadian Health Data Strategy should focus on establishing ***clear standardization that supports large scale interoperability*** for a shared foundational data set, an effective policy environment, and meaningful engagement to facilitate this change. ***This goal is achievable in the near future*** with strong support and meaningful engagement of public and private sector actors across the Canadian health system.

In January 2022, Infoway released the first draft of the Canadian FHIR Exchange (CA:FeX) Interoperability Specification. CA:FeX Release 1 (R1) was born out of the need to support a simple FHIR®-based exchange of an International Patient Summary-aligned document. While the first release only focused on this simple document exchange pattern, Infoway's vision was always for CA:FeX to evolve into a full-fledged, system-wide protocol guiding the exchange of primary and complex health data structures.

This early version of CA:FeX focused on a RESTful exchange of documents, a document pattern that FHIR offers multiple choices for. It aims to provide clarity to implementers by identifying some of the choices currently available, ranging from simple to a higher level of sophistication. As the specification development continues, the intent is to evolve CA:FeX into a more formal Integration Profile (similar to existing international profiles reviewed throughout this paper) that provides more comprehensive guidance on RESTful FHIR exchange patterns than what currently exists today.

With its upcoming revision (R2), CA:FeX aims to define a minimum set of system integration requirements for vendor systems supporting single- and multi-resource FHIR data exchanges, operations and other advanced FHIR®-aligned integration protocols (e.g., SMART on FHIR, IPA, etc.). Without a collective, consolidated approach to health information exchanges, Canada runs the risk of proliferation of interfaces and divergence from international standards that can only harm future pan-Canadian interoperability efforts. **This is a call to action to get involved in defining CA:FeX 2.0 capabilities and position them as the preferred, FHIR based, pan-Canadian HIE standard.**

Improving the Health of Canadians with CA:FeX

The experience of patients and their care teams in gaining timely access to comprehensive and accurate health information in support of both planned and unplanned care is varied across Canada's provinces and territories. Through the journey of a 48-year-old Canadian named Jesse, the value of adopting CA:FeX can be illustrated.

Jesse's Story – Suboptimal Health Information Exchange

Jesse is a 48-year-old who lives in suburban Canada. His family physician recently retired, and he is on a wait list to join a new primary care clinic. His initial appointment is in two months. He has a family history of heart disease and type 2 diabetes. Overall, he has been fairly healthy until now, but has recently felt unwell.

Step 1: Jesse attends a walk-in clinic and verbally shares his medical history and new symptoms with the walk-in physician.

- ✕ The lack of standardization in a data model and for exchange interfaces has led to challenging data collection from source systems to support a format expected by a patient portal, resulting in Jesse not having access to his data in an electronic format.
- ✕ Poor infrastructural setup and variation in the implementation of each provider system makes discovery of Jesse and his information very difficult within the health system. The walk-in physician must now rely on Jesse to provide this information again.

Step 2: The physician cannot access his past results and decides to order lab and diagnostic imaging tests. In a follow-up visit, the physician mentions that Jesse's "sugar is high" and talked about diet and exercise.

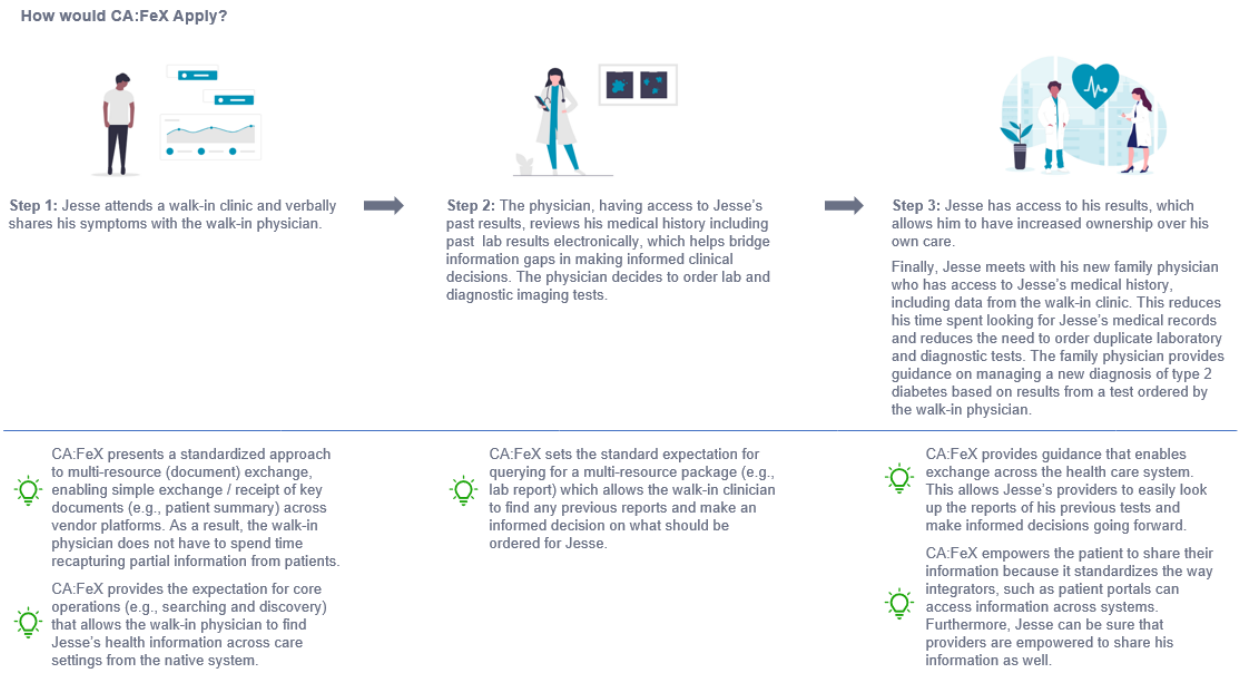
- ✕ Jesse's previous lab and diagnostic reports are dispersed across information systems with no standard way to retrieve / search for it. Furthermore, these reports are in varying formats that are not easily viewable in a single place for the walk-in physician. This has a direct impact on the care choices and ordering that the walk-in physician must make without the relevant information.

Step 3: Jesse does not have access to his results, but he is hoping to set this up through a patient portal before he meets with his new family physician. He is feeling overwhelmed and is seeking guidance.

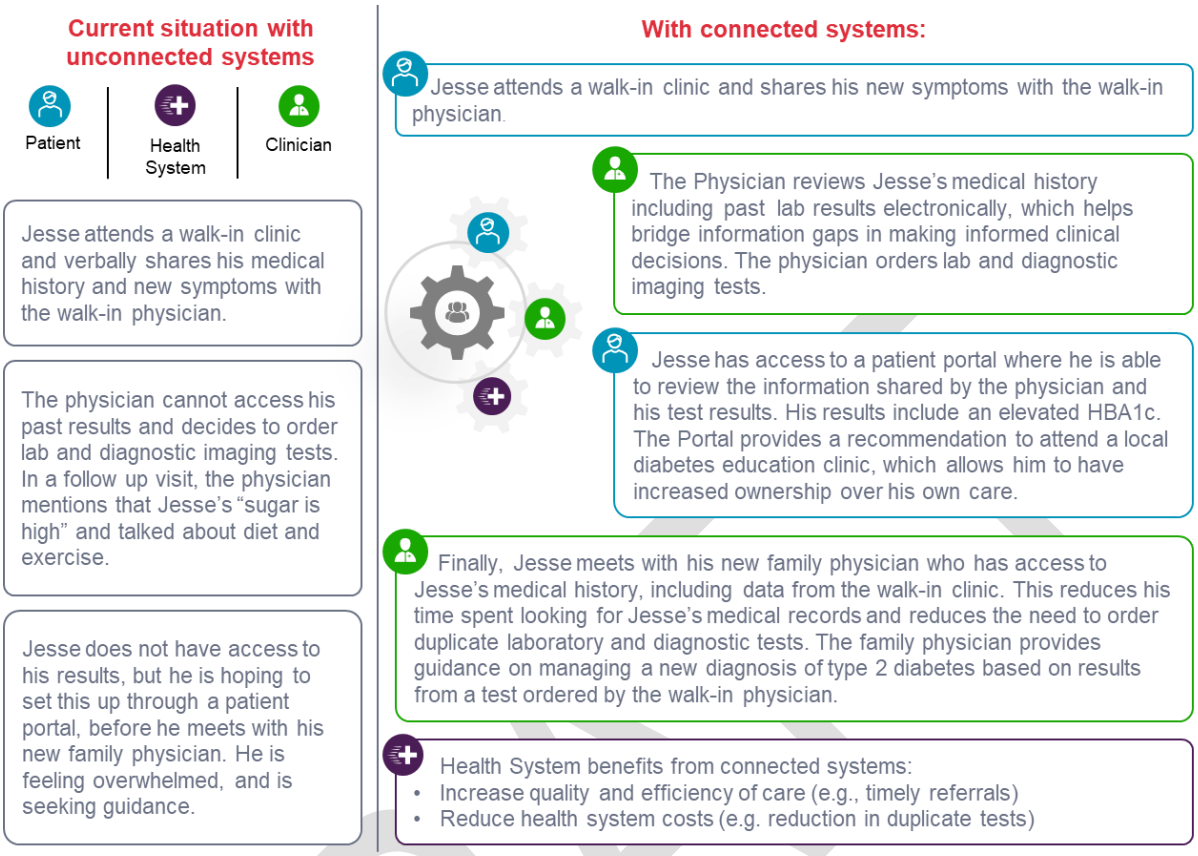
- ✕ As with the beginning of Jesse's journey, the poor infrastructure and standardization means that Jesse's information sits across multiple systems in multiple formats. Further, the expectation around the mechanism / actions required to retrieve the information from the multiple provider systems is unclear and manual, putting the onus on Jesse to manage his information.
- ✕ The lack of standard exchanges between providers to reflect a patient encounter, patient summary, etc. makes it difficult for providers to facilitate a transition to a new clinician. In cases where these documents do exist, technical choices around the type of document, format, etc. don't easily allow information to go from one provider to another or even to a central repository where providers could later retrieve it. This directly contributes to Jesse's poor experience.

Jesse's Story – Standardized Modern Health Information Exchange

The updated scenario with the use of CA:FeX, in concert with other pan-Canadian interoperability roadmap initiatives, would shift the experience of both Jesse and his care team as follows:



Jesse's experience is transformed from a sub-optimal and inefficient set of disconnected care processes to a connected, patient-centered care experience. The infographic below highlights the difference in Jesse and his care team's experiences, and highlights additional health system benefits:



For a more holistic overview of the approach and guiding principles as it pertains to the development of CA:FeX, please see **Appendix C**.

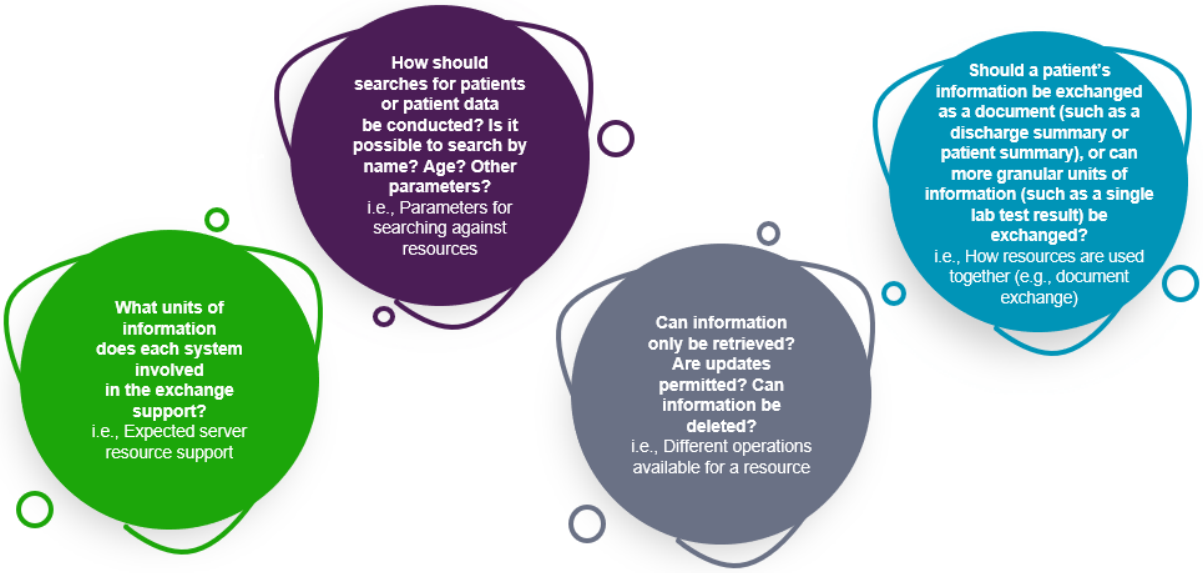
CA:FeX- Optimizing Canada's Health Resources

By establishing a standard set of data definitions and their exchange patterns – that is, a standard way of describing key aspects of a patient's health record and moving that data between digital health systems – CA:FeX will help to establish a common set of expectations that participants in patient-centered health information exchange can rely on. This level of standardization and convergence across pan-Canadian jurisdictions will accelerate the implementation of new digital health solutions, drive improved integration between existing solutions, and directly support the pan-Canadian Health Data Strategy. It will also reduce costs and mitigate risks arising from complex, custom integrations to the benefit of both healthcare organizations and digital health solution vendors.

FHIR and Pan-Canadian Health System Collaboration

One of the strengths of FHIR as a specification is in its ability to offer choice. FHIR's flexibility to support documents, messages and web services lends itself well to solving a variety of problems; however, this flexibility can also lead to challenges in interoperability if vendors and health systems select vastly different means of solving similar use cases.

For example, varying choices could be made with respect to exchanging basic information about a patient using FHIR, including (but not limited) to the following:



There is no single correct answer to these questions; indeed, there are many entirely reasonable and potentially correct answers.; However, two organizations making different decisions on *any* of these items could limit their ability to exchange data with one another, leading to time-consuming, costly, and complex custom integrations. For more detail on the layers of decision making and divergence that this flexibility can lead to in real-world implementations, see **Appendix A**.

Limiting these choices to simpler, repeatable capabilities scaled up to ecosystem level, combined with the right level of predictable access controls that respect privacy and consent, can turn FHIR® into a very powerful driver of change in the pan-Canadian health information exchange ecosystem. By establishing pan-Canadian agreement on some of these fundamental decisions for exchanging a core set of patient information, ***it is possible to make a transformative change in the state of person-centered health information exchange in Canada***.

Canada, the G7 and International Health Information Exchange

From a global perspective, there is extensive international investment to standardize the minimum viable data model (that is, the minimum set of data elements that must be exchanged in order to be useful, generally referred to as profile support) and the foundational requirements for any health information exchange interface (that is, how data is exchanged between sender and receiver, generally referred to as interaction support) to advance interoperability. These standards enhance clinical and patient safety information systems by promoting high quality data collection for operational and secondary use. Specifically, these modern standards are improving clinical decision support, enabling optimization of care processes and advancing translational research.

Data / Content Model Standardization (Profile Support)

As an example, HL7's International Patient Summary ("IPS") specification, is seeing widespread global adoption. The IPS is a minimal, standardized set of clinical data about a patient that can be readily used by all clinicians for both unscheduled and scheduled care. The IPS includes the most important holistic facts about a patient's health in a specialty-agnostic and condition-independent manner. The IPS primarily defines the profile support – that is, a mandatory set of data elements and corresponding sets of valid values – required for any health system actor that consumes or produces a Patient Summary. The intent is for IPS to serve as a foundational building block for jurisdictions / countries / health systems to leverage and localize.

Furthermore, countries around the world have recognized that there is a need to create country-level profile sets that best describe the underlying data needs of their national healthcare systems (e.g., identifier systems, national terminology). Notable developments in recent years include US Core in the United States, as well as others in Europe and Great Britain, Australia and New Zealand, to just name a few. These profile sets codify the core data needed by a jurisdiction's health system and define sets of valid values for data elements with discrete values.

Canada needs a similar approach that will not only be aligned with Canadian healthcare needs, but also with international standards such as International Patient Summary and International Patient Access (IPA). ***Consensus on a core Canadian data model will be a key enabler of person-centered health information exchange across the country***.

Exchange Interface Standardization (Interaction Support)

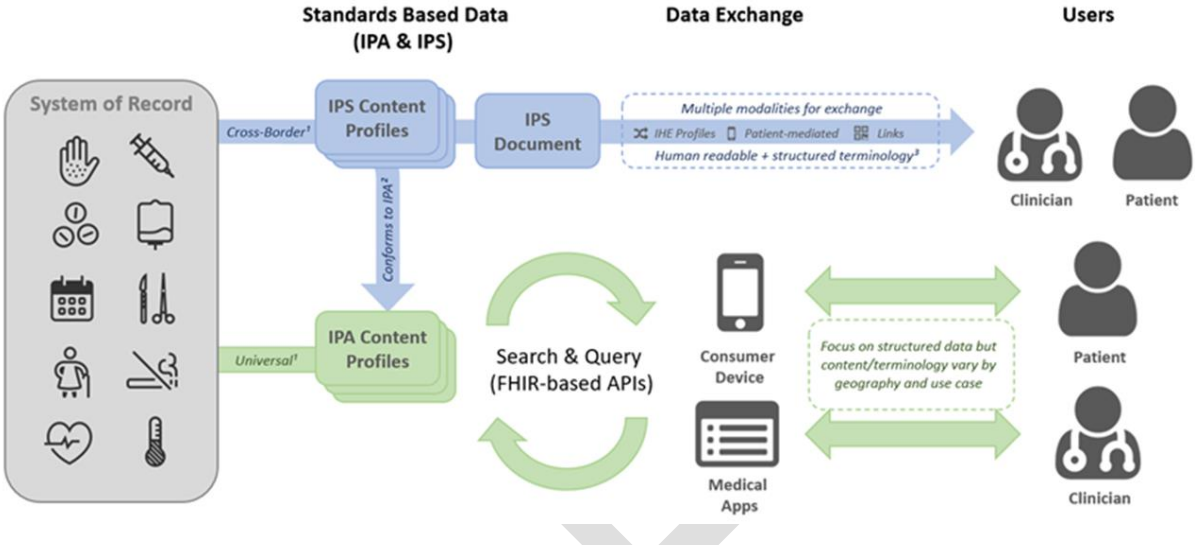
Interoperability has, in the past, often focused on the creation and exchange of *documents* – collections of data elements intended for a specific purpose (a discharge summary, for example). Integrating the Healthcare Enterprise ("IHE") is a global organization that promotes the use of established standards to facilitate health information exchange. IHE's Cross-Enterprise Document Sharing ("XDS") and Mobile access to Health Documents ("MHD") integration profiles have widespread adoption in countries, such as the US and many jurisdictions in Europe. These IHE integration profiles provide guidance for each actor in a health information exchange event – how data should be structured and the mechanics of how data exchange ought to take place. This detailed guidance significantly accelerates integration between solutions that both support the same integration profiles.

The document-based paradigm of health data exchange is beginning to fall out of favour, but the sort of detailed guidance around how the exchange of data should take place provided by IHE profiles remains valuable. As new technologies emerge and the capability of FHIR-based systems expand, there is an opportunity to move toward a more granular, dynamic exchange of information.

An example of this modernization is HL7's International Patient Access ("IPA") draft specification which describes how an application can access information from a clinical information system with a FHIR-based API. IPA addresses the following key areas:

- **Profile Support:** IPA sets minimal expectations around the data model that the IPS FHIR profiles align to (at minimum). Essentially, IPA's profile support guidance provides a subset of the rules and expectations of the IPS specification without building complete dependence on the more holistic IPS data model requirements.
- **Interaction Support:** The focus of the specification is on outlining the exchange pattern and capabilities required to access data using RESTful FHIR APIs and SMART on FHIR (

SMART is an open-source, standards-based API that leverages the OAuth 2.0 standard to provide secure, universal access to electron health records).



***Source:** HL7 Blog.*

Countries across the globe are already referencing these standards and collaborating to drive interoperability while building commonality across jurisdictions, driving future scalability and predictability in the market. This breakdown between profile and interaction support to set the minimum expectations for health information exchanges creates a more open environment where the cost to participate in health information exchange is lower across jurisdictions and care settings. Simply put, widespread adoption of common standards around profile and interaction support will enable rapid growth of person-centered health information exchange, making it vastly easier to integrate applications and share health information wherever and whenever it is needed to support care delivery or enable patients to better manage their health.

To see how countries, such as the United States, have mirrored and aligned with this approach, see the US case study in **Appendix B**.

Building Momentum: CA:FeX and the CA-Core

Over the course of the past two years, Infoway, in collaboration with participating Canadian jurisdictions, drove Canadian adaptation of the IPS with the introduction of the pan-Canadian Patient Summary (“PS-CA”) specification. As previously discussed, exchange patterns such as XDS and MHD, were explored as patterns that could be leveraged to exchange a Patient Summary in Canada. In line with global trends, Canadian implementers quickly agreed that there is a need to harmonize around a modern RESTful exchange pattern for a Patient Summary document that would easily lend itself to other forms of data exchanges in the future. This ultimately drove the birth of the CA:FeX specification and a more mature view on how FHIR-based exchange can develop at the pan-Canadian level.

As a result of the above and in line with international standards, the pan-Canadian approach will have specifications that address both profile and interaction support as follows:

- **Profile Support:** Holistic profile support (i.e., "CA-Core") will be driven by the development of a pan-Canadian core data model, similar to the profile / content guidance provided by the US Core that was the FHIR implementation of the United States Core Data for Interoperability (USCDI **Appendix B**). The CA-Core will provide profile support guidance that can then be leveraged to build out more mature CA:FeX capabilities in the future.
- **Interaction Support:** The CA:FeX specification package intends to define and guide the approach to information sharing using RESTful FHIR capabilities. CA:FeX will be rooted in best practices from international specifications (e.g., IPA, QEDm, US Core, SMART on FHIR, etc.) that are feasible for the Canadian market to standardize around. As noted above, as CA:FeX matures, it will leverage the profile support guidance of a pan-Canadian data model to build toward more sophisticated exchange capabilities.

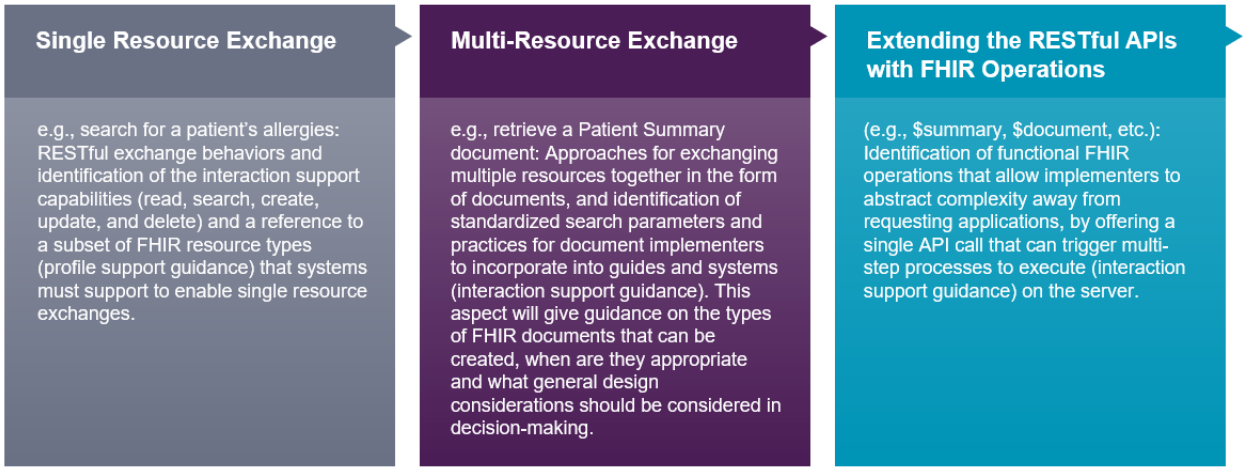
The Current CA:FeX Trial Implementation

Given CA:FeX was initially developed to enable the exchange of Patient Summaries as a FHIR Document, the first release primarily outlines a multi-resource exchange pattern for the search, retrieval, and submission of a Bundle/Composition FHIR Document (see **Appendix A** for other multi-resource formats and the implications). While CA:FeX stemmed from the need to exchange a Patient Summary, this guidance is intended to be agnostic with regard to the nature of the document and applied to documents well beyond Patient Summary. **It is the first step toward Canada reaching the level of maturity present in other integration profiles available in the global ecosystem.**

Looking Forward: CA:FeX v2.0.0 and Beyond

As CA:FeX evolves, it will broaden in scope to support more than just a single multi-resource exchange pattern. CA:FeX R2 is expected to expand to single resource exchange, other types of multi resource exchange and the inclusion of APIs with FHIR operations.

At a glance, CA:FeX will provide guidance with respect to the following exchange patterns:



The goal for CA:FeX is to act as a key building block and a guide within the arsenal of interoperability tools that provide vendors with the ability to understand and plan for the minimum expectation to *interact* within any health IT interface, regardless of jurisdiction.

Below highlights some of the details that can be expected in the next version:

- Published expectations for what the minimal viable resources and interactions that any FHIR server in Canada should include. This means that future versions of CA:FeX will drive more sophisticated exchange that references and builds upon a pan-Canadian data model, such as CA-Core, and its resources.
- At a more granular level, CA:FeX v2.0.0 DFT will include interaction guidance for single resource exchange, search parameters, and capability statements that can be directly tested against. This growth will enable the exchange of information that goes far beyond the exchange of a document, expanding the use cases that CA:FeX applies to and the clinical workflows that it can empower.

These, and many more aspects of this future specification will be developed in partnership with a pan-Canadian Governance table that will reflect the right need and arrive at a state that best supports data sharing and integration efforts. To jump start this process, Infoway has prepared a shared project on the Canadian FHIR Registry that will host the Implementation Guide. Details can be found on https://simplifier.net/ca-fex-canadian-fhir-exchange and the first draft of the implementation guide available here: https://simplifier.net/guide/ca-fex?version=2.0.0DFT.

A Call to Action

The benefits of adopting CA:FeX are extensive, but they will only be realized with the support and participation of people and organizations across the Canadian health system. Immediate and specific actions on the part of governments, health authorities, software vendors and other health system stakeholders are needed if CA:FeX is to succeed, including:

- Ensure technical teams responsible for implementing health information exchange have access to high-quality training and supporting resources. These teams must have a strong understanding of the technologies available and the implementations that already exist, and the importance of investing in high-quality training and upskilling cannot be overstated
- Participate and make meaningful contributions to pan-Canadian initiatives to set interoperability roadmap priorities and tackle problems in a unified way. The skills and understanding highlighted in the previous bullet will help jurisdictional and vendor teams engage more effectively in these initiatives
- Actively participate in the key governance bodies to ensure pan-Canadian alignment on key interoperability decisions and the appropriate infrastructure for ongoing collaboration
- Align jurisdictional and organizational policies across the country – building on pan-Canada interoperability discussions – to incentivize vendors to adopt a common approach to health information exchange

For any jurisdiction planning modernization projects that involve decisions on API Gateways, defining data formats and access channels, access controls and integrations with digital identities, consent and role-based access, participation in the CA:FeX initiative and broader pan-Canadian interoperability discussions is critically important. Establishing alignment with other jurisdictions before investing significant time and money will be essential to the future of successful health information exchange in Canada and the execution of the pan-Canadian Health Data Strategy.

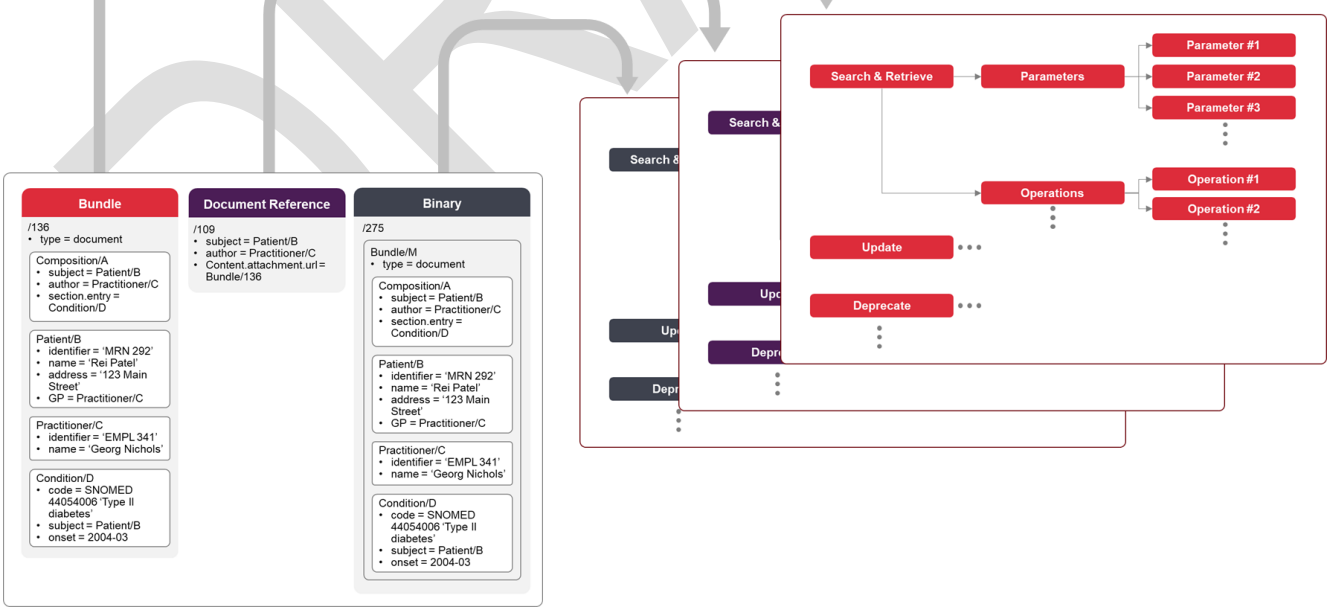
Canada is at a crossroads. The Canadian health system could, with commitment and effort from stakeholders across the country, become a leader in interoperability and health information exchange to the immense benefit of all Canadians. Absent that commitment and effort, however, the health system will continue to operate with disconnected silos of information and Canada will remain an international laggard. Health system leaders and digital health technologists across Canada must seize the opportunity now available and commit to working together to enable true person-centered health information exchange.

Appendix A: Illustrative Discussion – Multi-Resource Exchange

Below highlights a real-world illustration of the layers of decision-making required and the level of optionality for a simple multi-resource exchange (e.g., a jurisdiction would like to facilitate the exchange of a health care document). This example will show the inter-dependency of choices and how quickly it creates variation just within the exchange interface expectations.

First off, when considering a multi-resource exchange, there are foundational, far-reaching choices that must be made, including whether or not that multi-resource view will exist as a static document in time or an on-the-fly document assembly that does not persist. This choice alone will have significant implications on the architecture and exchange patterns required.

For the sake of simplicity, this discussion is operating under the assumption that a multi-resource assembly will persist as a static document. There are still a number of decisions that follow, including the format for packaging a series of resources to facilitate a multi-resource exchange in the form of a document. There are multiple formats to represent the assembly of resources, such as a FHIR Document / Bundle, Document Reference, Binary File, etc. The multi-resource format chosen has implications on the basic functions (e.g., Search & Retrieve, Update, Deprecate) and how they are executed. For example, the choice of the multi-resource format will have a direct impact on how a multi-resource packet can be searched and retrieved, including further choices around search parameters, FHIR operations, etc.



Without a convergent approach, each implementer will have the opportunity to make their own decisions on the format of a multi-resource exchange and all of the other choices that follow. There may be multiple drivers for an implementer's choice, depending on the use case and priorities. The table below highlights a simple analysis of the various multi-resource formats mapped across some of the priorities an implementer may have when considering multi-resource exchange and documents.

Icon	Definition
🟢	Excellent. The format is superior in its native support for this capability.
🟡	Good. The format supports this capability but may require guidance beyond the base specification.
🟠	Marginal. The format supports this capability in most basic ways but may require augmentation to overcome limitations.
🔴	Poor. The format does not support this capability beyond the most basic use; limitations are significant.
⚫	Not applicable. This capability is not applicable to the document format.

Capability	Composition	FHIR Document	Binary	Document-Reference
Search/Retrieve	🟡	🟠	🔴	🟢
Resilience/Portability	🟠	🟢	🟢	🟡
Signing	🔴	🟡	🟡	🟡
Lifecycle Management	🟠	🟠	🔴	🟢
Currency	🟢	🔴	🔴	🟡
Stability	🔴	🟢	🟢	🟡
Flexibility	🟠	🟠	🟡	🟢
Resource Accessibility	🟢	🔴	⚫	🟡
Resource Independence	🔴	🟢	⚫	🟡

The table above quickly makes it evident that there is no *'silver bullet'* that meets an implementer's every need perfectly. There are pros and cons to each choice, naturally lending itself to variation in the market based on what that implementer chooses to prioritize. Prioritizations will vary based on the use case at-hand and local needs, which makes it less likely to scale to other use cases in the future.

Appendix B: Evolution of the US Core

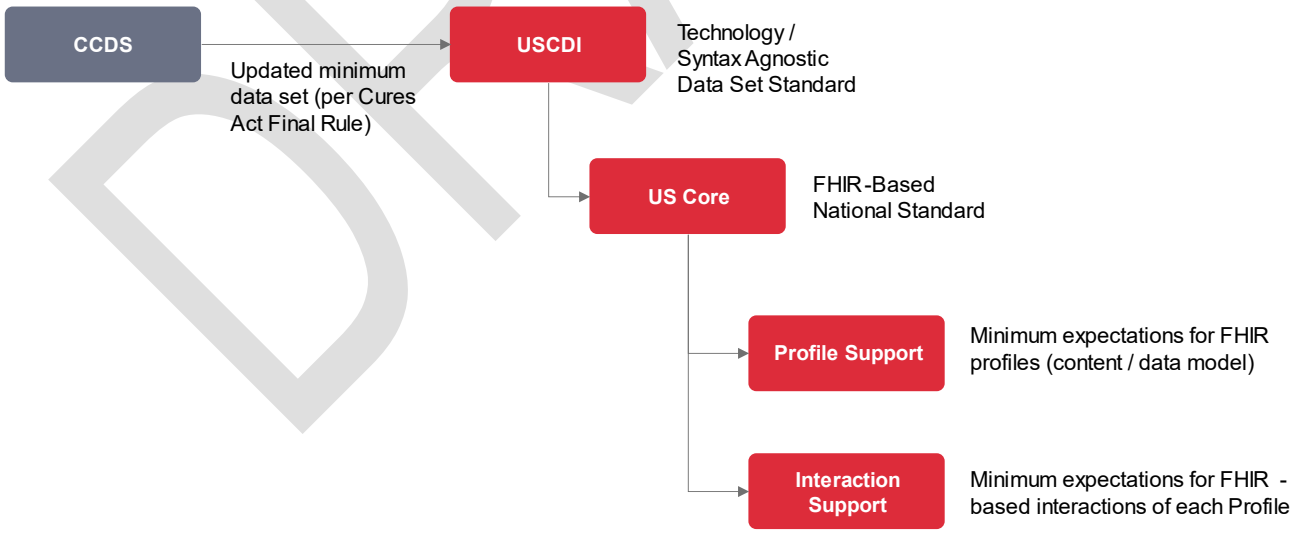
Case Study: Modernization of Established US Standardization

In line with the broader international market, the United States has long invested in standardizing the expectations for national health information exchange. Through the Office of the National Coordinator for Health IT ("ONC"), there is an extensive system of standards, conformance and certification processes, and incentive programs to drive interoperability among health IT vendors.

In recent years the US has invested in the modernization of its interoperability conformance and certification expectations to accommodate the emergence of new technology. In 2020 the Cures Act Final Rule was released, suggesting changes to conformance standards required to drive interoperability and reduce information blocking across the country. As a result, despite widespread adoption of the national Common Clinical Data Set ("CCDS") and relatively established legacy exchange patterns (e.g., XDS), the US released updated guidance from both a data model and exchange interface perspective.

The ruling in 2020 required that US vendors transition from CCDS to the United States Core Data for Interoperability ("USCDI"). While USCDI guidance is completely agnostic of technology and syntax, the new US Core FHIR implementation guide focuses on guidance for both profile and interaction support as follows:

- **Profile Support:** This outlines the expectations around the data content / data model. The standard lists the profiles and FHIR resources to the corresponding USCDI data elements (agnostic of technology / syntax).
- **Interaction Support:** Describes the technology actors expected to conform to the US Core and the minimum RESTful interactions for each profile.



It should be noted that the US Core is expected to develop in alignment with other international profile and interaction support guidance, such as the IPA. In fact, IPA documentation lists the US Core (as of 2022) as one of a few standards that are consistent with the guidance of IPA. Again, this shows the international convergence with respect to interoperability that is expected to create predictability across markets.

For a detailed overview of the US Core and its success to-date, please see below.

Detailed Overview: US Core	
Description	The US Core was originally developed as part of ONC's Data Access Framework ("DAF") project, which kicked off in 2013. By 2015, the Argonaut Data Query Implementation Guide superseded that of the DAF project; the iGuide provided guidance on security, authorization and querying of the nationally accepted CCDS and static documents. The US Core evolved out of the Argonaut initiative with the first draft published in 2017. In 2020, the Cures Act Final Rule was released which required that US certified vendors move from the support of CCDS to the newly developed USCDI data set (developed in 2015). Further, this legislation called for actions to remove information blocking across the health system. US Core now plays a vital role in executing this legislation and, more broadly, modernizing health information exchange. The US Core defines the minimum set of constraints on the FHIR resources to create the US Core profiles (mapped to the USCDI). In addition, the guidance also defines the minimum set of FHIR RESTful interactions for each of the US Core profiles to access patient data.
Policy & Legislation	The United States mandates that health information vendors are certified electronic health record technology ("CEHRT"). Providers are incentivized to select CEHRTs because of the funding mechanisms (meaningful use payments) tied to the utilization of these systems. The Cures Act Final Rule in 2020 mandated that CEHRTs must transition to USCDI. The US Core maps FHIR profiles directly to this data set, outlining the minimum constraints for conformance. CEHRT also tests for minimum API requirements for patient and population services, which prescribes the minimum interaction support (API requirements) for the applicable profiles. The tests for minimum interaction support are consistent with the expectations of the US Core which is referenced throughout CEHRT testing documentation.
Structure / Approach	The US Core outlines guidance around the following key components: • **Profile Support:** The expectations around the data model (profiles, extensions, terminology). The standard lists the profiles and FHIR

	resources to the corresponding USCDI data elements (agnostic of technology / syntax). • **Interaction Support:** Describes the technology actors expected to conform to the US Core and the minimum RESTful interactions / documentation (search parameters, operations, server & client capability statements). In current state, the US Core gives vendors the choice on two levels of conformance: • Profile Support • Profile + Interaction Support The most common option is the latter because it is the approach that aligns well with the certification requirements in the 21st Century Cures Act Final Rule (e.g., that the server supports a number of profiles and the appropriate search parameters / operations to retrieve them). In less common instances, Profile Support may be the appropriate option. For instance, if an implementer is using a FHIR Bulk Data Access approach and therefore only needs to export data (that is compliant with the data model), they could be using different server interactions.
Success Factors	Key success factors for US Core to-date include the following: • **Regulatory Relationship:** ONC tied CEHRT certification directly to the compensation model (Meaningful Use) of hospitals receiving Medicare and Medicaid payments. CEHRT certification is consistent with the data and interaction support outlined with the US Core. • **Evolution from Predecessor:** The US Core was accelerated through the Argonaut Project which outlined key requirements that are now a part of the US Core. Key learnings from years of development prior to the US Core was carried through the US Core standard. • **Update Legislation:** The 21st Century Cures Act Final Rule essentially added additional requirements for standardization of APIs to make it easier for patients to access their health information on their smart phones. HL7 FHIR US Core and other guides, such as HL7 CDA & HL7 FHIR SMART Application Launch Framework, HL7 FHIR Bulk Data Access, aligned to the expectations to ensure that vendors could implement against them and meet the CEHRT requirements. • **Testing Infrastructure & Support:** The ONC Certification (g)(10) Standardized API Test Kit is a tool for H7 FHIR services to meet the requirements set out in the CEHRT criteria. This assists developers in

testing APIs against mandated implementation guides, such as the Standardized API for Patient and Population Services criterion (consistent with US Core requirements).

- **Continuous, Iterative Expansion and Refinement:** The US Core started with 19 profiles in 2017 that met the ONC 2015 Edition CCDS elements. Since its inception, it has grown to 24, 26, 35, and 45 profiles in 2018, 2020, 2021, and 2022, respectively. The standard is continuously maintained to meet new legislation requirements as well as needs from the market.
- **Foundational & Extensible:** By supplying a foundation of FHIR profiles & server/API expectations that certified US EHR vendors included in their products, US Core was able to pave the way and offset the work required to implement FHIR to exchange data through US Realm initiatives that followed. For instance, the Bidirectional Services eReferral ("BSeR") implementation guide was able to build on top of the US Core profiles to define only a handful of additional elements that were necessary for vendors to add to their capabilities in order to be compliant with the BSeR implementation requirements. To put this in practical terms, the infrastructure established US Core ensured that vendors' FHIR APIs already supported the ability supply and retrieve 2/3 of the elements that were necessary for the exchange of organization information for eReferrals.